ABSTRACT

The present invention relates to the production of thin film epilayers of III-V and other compounds with acceptor doping wherein the acceptor thermally stabilizes the epilayer, stabilize the naturally incorporated native defect population and therewith maintain the epilayer's beneficial properties upon annealing among other advantageous effects. In particular, balanced doping in which the acceptor concentration is similar to (but does not exceed) the antisite defects in the as-grown material is shown to be particularly advantageous in providing thermal stability, high resistivity and ultrashort trapping times. In particular, MBE growth of LT-GaAs epilayers with balanced Be doping is described in detail. The growth conditions greatly enhance the materials reproducibility (that is, the yield in processed devices). Such growth techniques can be transferred to other III-V materials if the growth conditions are accurately reproduced. Materials produced herein also demonstrate advantages in reproducibility, reliability and radiation hardening.